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SPECIFICATION

1. Title of th Invention

Corrosion resistant zinc alloys

2. Scope of the Patent Claims

A corrosion resistant zinc alloy, characterized in that it contains from 1 to 22 wt% aluminium and from 0.01 to 0.10 wt% nickel with the remainder comprising zinc.

Detailed Description of the Invention

Industrial Field of the Invention

This invention concerns corrosion resistant zinc alloys, and especially corrosion resistant zinc alloys with which inter-granular corrosion in harsh corrosive environments such as those in coastal regions is prevented.

Prior Art

Zinc-aluminium alloys differ from zinc alone in that they can be subjected to plastic working such as extrusion, and they have other advantages such as being corroded to a lesser extent than zinc alone and in that the pitting corrosion such as that seen with aluminium alone does not occur even in harsh corrosive environments, such as those in coastal regions for example, and they are useful as a corrosion preventing coating layer on steel wires for example.

Problems to be Resolved by the Invention

However, with the conventional zinc-aluminium alloys there is little corrosion over the whole surface but local corrosion due to inter-granular corrosion does occur. This inter-granular corrosion is corrosion which arises at the crystal grain boundaries in the metal structure and it proceeds without any change which can be seen from the outside and leads to local failure. The inclusion of a prescribed amount of magnesium has already been proposed for preventing the inter-granular corrosion of zinc-aluminium alloys, but magnesium reduces the mechanical strength and adversely affects the extrusion characteristics of the alloy and so it cannot be used in the covering layers on steel wires for example.

Hence, the purpose of the present invention is to realize a corrosion resistant zinc alloy with which the occurrence of inter-granular corrosion is prevented and with which there is no decline in the plastic working properties and mechanic strength.

Means of Resolving These Problems

In this invention from 0.01 to 0.10 wt% of nickel is added to a zinc-aluminium alloy so that the aluminium content is from 1 to 22 wt% with the remainder comprising zinc in order to realize a corrosion resistant zinc alloy with which the occurrence of inter-granular corrosion is prevented and there is no decline in the plastic working properties and mechanical strength.

From among these alloys, those which contain from 10 to 22% (signifying wt%, same hereinafter) of aluminium are especially desirable in respect of corrosion resistance. If the aluminium content exceeds 22% then the workability of the alloy becomes poor. With an aluminium content of from 10 to 22% the alloys which have a nickel content of from 0.01 to 0.05% are especially desirable in respect of corrosion resistance.

The invention is described in more detail below by means of illustrative examples.

Example 1

Zinc-aluminium-nickel alloys which contained 22% aluminium and the amount of nickel shown in Table 1 were prepared.

A 100 hour pressure cooker test (referred to hereinafter as a PCT) was carried out with the alloys obtained and the change in weight before and after the test was measured. This change in weight corresponds to the increase in weight due to corrosion. The results are shown in Table 1. Moreover, in Table 1 the samples numbered 1 to 4 are examples of the invention and sample numbers 5 and above are comparative examples which have compositions outside the scope of the present invention.

As is clear from Table 1, the increase in weight due to corrosion in the PCT was smaller with the zinc-aluminium-nickel alloys which contained 22% aluminium and from 0.01 to 0.10% nickel than in the comparative examples. This shows that there was less inter-granular corrosion with the alloys of this invention. Furthermore, these alloys did not give rise to a decline in the plastic working properties and mechanical strength.

Table 1

	Sample Number	Composition (wt%)			Increase in Weight due to Corrosion (g/m^2)
		Al	Ni	Zn	
This Invention	1	22	0.01	bal.	97
	2		0.02	bal.	78
	3		0.05	bal.	89
	4		0.10	bal.	104
Comparative Examples	5	22	0	78	112
	6		0.005	bal.	109
	7		0.15	bal.	115
	8		0.20	bal.	128

Example 2

Zinc-aluminium-nickel alloys which contained 13% aluminium and the amount of nickel shown in Table 2 were prepared.

A 100 hour PCT was carried out with the alloys obtained and the change in weight before and after the test was measured. The results are shown in Table 2. In Table 2 the samples numbered 21 to 24 are examples of the invention and sample numbers 25 and above are comparative examples which have compositions outside the scope of the present invention.

As is clear from Table 2, the increase in weight due to corrosion in the PCT was smaller with the zinc-aluminium-nickel alloys which contained 13% aluminium and from 0.01 to 0.10% nickel than in the comparative examples. This shows that there was less inter-granular corrosion with the alloys of this invention

Table 2

	Sample Number	Composition (wt%)			Increase in Weight due to Corrosion (g/m^2)
		Al	Ni	Zn	
This Invention	21	13	0.01	bal.	103
	22		0.02	bal.	82
	23		0.05	bal.	95
	24		0.10	bal.	110
Comparative Examples	25	13	0	87	123
	26		0.005	bal.	127
	27		0.15	bal.	115
	28		0.20	bal.	131

Example 3

Zinc-aluminium-nickel alloys which contained 7% aluminium and the amount of nickel shown in Table 3 were prepared.

A 100 hour PCT was carried out with the alloys obtained and the change in weight before and after the test was measured. The results are shown in Table 3. In Table 3 the samples numbered 31 to 34 are examples of the invention and sample numbers 35 and above are comparative examples which have compositions outside the scope of the present invention.

As is clear from Table 3, the increase in weight due to corrosion in the PCT was smaller with the zinc-aluminium-nickel alloys which contained 7% aluminium and from 0.01 to 0.10% nickel than with the others, and this shows that there was less inter-granular corrosion.

Table 3

	Sample Number	Composition (wt%)			Increase in Weight due to Corrosion (g/m^2)
		Al	Ni	Zn	
This Invention	31	7	0.01	bal.	100
	32	7	0.02	bal.	80
	33	7	0.05	bal.	90
	34	7	0.10	bal.	105
Comparative Examples	35	7	0	93	120
	36	7	0.005	bal.	121
	37	7	0.15	bal.	125
	38	7	0.20	bal.	130

Example 4

Zinc-aluminium-nickel alloys which contained 1% aluminium and the amount of nickel shown in Table 4 were prepared.

A 100 hour PCT was carried out with the alloys obtained and the change in weight before and after the test was measured. The results are shown in Table 4. In Table 4 the samples numbered 41 to 44 are examples of the invention and sample numbers 45 and above are comparative examples which have compositions outside the scope of the present invention.

Table 4

	Sample Number	Composition (wt%)			Increase in Weight due to Corrosion (g/m^2)
		Al	Ni	Zn	
This Invention	41	1	0.01	bal.	95
	42	1	0.02	bal.	75
	43	1	0.05	bal.	88
	44	1	0.10	bal.	100
Comparative Examples	45	1	0	93	115
	46	1	0.005	bal.	110
	47	1	0.15	bal.	115
	48	1	0.20	bal.	125

As is clear from Table 4, the increase in weight due to corrosion in the PCT was smaller with the zinc-aluminium-nickel alloys which contained 1% aluminium and from 0.01 to 0.10% nickel than with the others, and this shows that there was less inter-granular corrosion.

Effect of the Invention

The corrosion resistant zinc alloys of this invention prevent the occurrence of local corrosion by inter-granular corrosion and no decline in plastic working properties and mechanic strength is seen and they are useful as corrosion preventing coating layers for steel wire for example.

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